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VL-2488-1-O

DEVELOPMENT OF ELECTROPHORETIC PROCESS FOR  
COATING T-53 AIR DIFFUSER, EXHAUST DIFFUSER, AND  
COMBUSTION CHAMBER HOUSING WITH "SERMETEL W"<sup>®</sup>

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PHASE I TECHNICAL REPORT

K. A. Gebler

21 June 1967 - 21 August 1967

Prepared for

Headquarters, U. S. Army Aviation Materiel Command  
St. Louis, Missouri 63166

By

Vitro Laboratories  
West Orange, New Jersey 07052

Prepared Under

Contract No. DAAJ01-67-C-2207(G)

Vitro Job No. 2488

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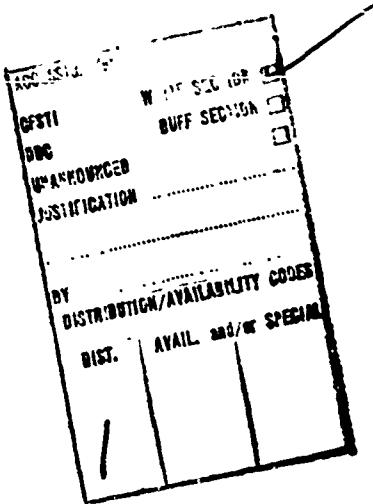
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## ABSTRACT

This report covers activities accomplished during the first two months (Phase I) of a ten (10) month program to develop an electrophoretic coating method for the application of "SERMETEL W"<sup>(R)\*</sup> to all critical surfaces of the exhaust diffuser, air diffuser and combustion chamber housing of the T-53 engine. "SERMETEL W" has been classified by various engine manufacturers and DOD agencies as the best coating available for corrosion protection. Its application to the complex parts included in this program has not been possible by other conventional means. The development of the electrophoretic methods to coat these parts will greatly extend the corrosion protection now afforded by sprayed-on high-temperature aluminum paint. During this phase, the design and procurement of coating tanks, power supplies, humidification chambers, and miscellaneous materials have been made. Utilizing drawings and sections cut from reject parts obtained from ARADMAC, the design and fabrication of jigs and fixtures were started. Design of three jigs and fixtures was accomplished to take advantage of any radial symmetry of the hardware item and to provide flexibility for modification that may be required in later phases of this program. All objectives in Phase I have been accomplished.

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## FOREWORD

This Phase I Technical Report covers work performed under Contract No. DAAJ01-67-C-2207(G) during the period 21 June 1967 to 21 August 1967.

This program is being conducted by the Chemistry and Arc Materials Department, West Orange Laboratory, Vitro Laboratories Division. The program is under the technical direction of F. E. Stevens, Directorate of Research, Development and Engineering, AVCOM, St. Louis, Missouri 63116.

Kenneth A. Gebler is the Vitro Project Leader. No other major contributions were made to this report by other persons.

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## OBJECTIVES

The developmental effort under this program has two major objectives. The first is to develop the process methods and equipments to electro-phoretically coat "SERMETEL W" on all critical surfaces of three T-53 engine components. These components, the exhaust diffuser, air diffuser, and combustion chamber housing are shown in Figures 1, 2, and 3, respectively.

The second objective, after successful coating procedures and equipment have been developed, is to coat a minimum of two parts of each type and deliver these parts to a site selected by the Contracting Officer for evaluation and qualification of the coating.

## PROGRAM PLAN

The developmental effort has been divided into five essential phases:

- I. Design and Installation of Coating Equipment
- II. Dummy Coating Runs and Refinement of Electrode Design
- III. Heat Treatment and Evaluation of Coated Components
- IV. Full Scale Coating Trials
- V. Delivery of Final Specimens.

Through necessity, the work in each of the five phases will overlap and efforts will, therefore, be concurrent in one or more phases as the program progresses.

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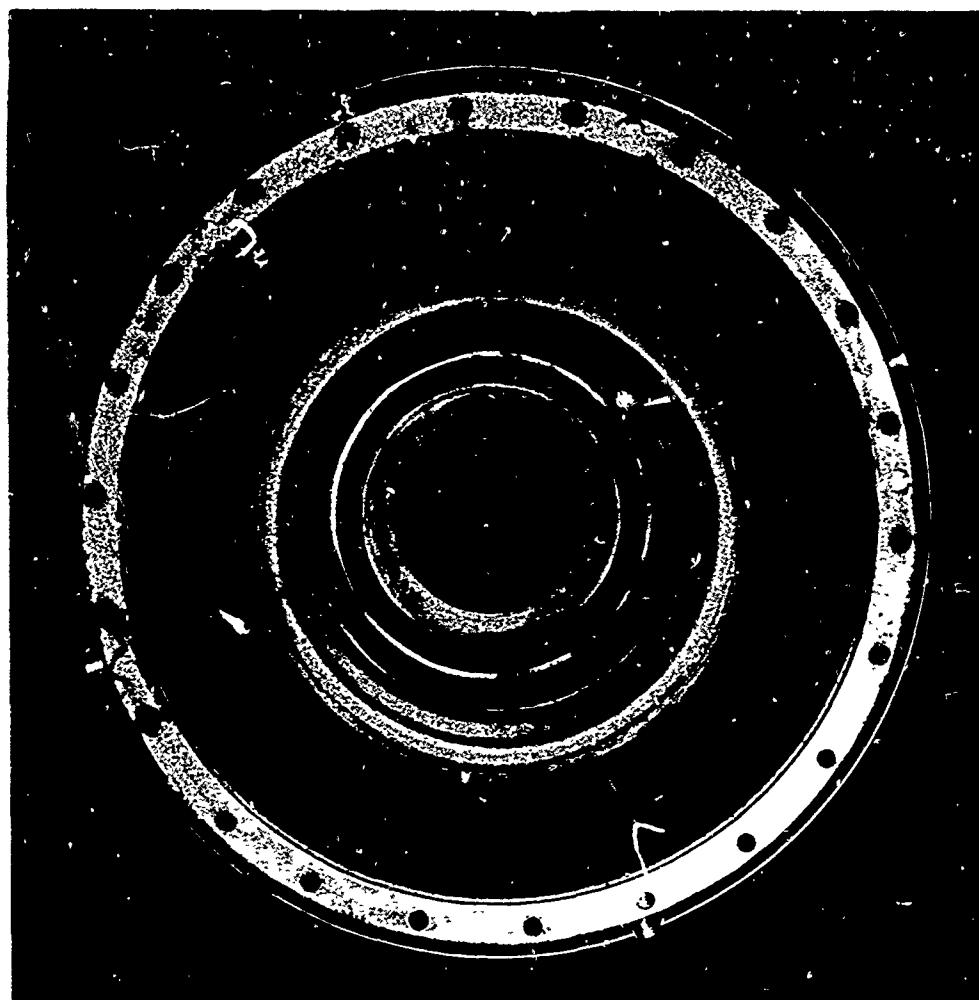


FIGURE 1

EXHAUST DIFFUSER FOR T-53 ENGINE  
P/N 1-150-110-01

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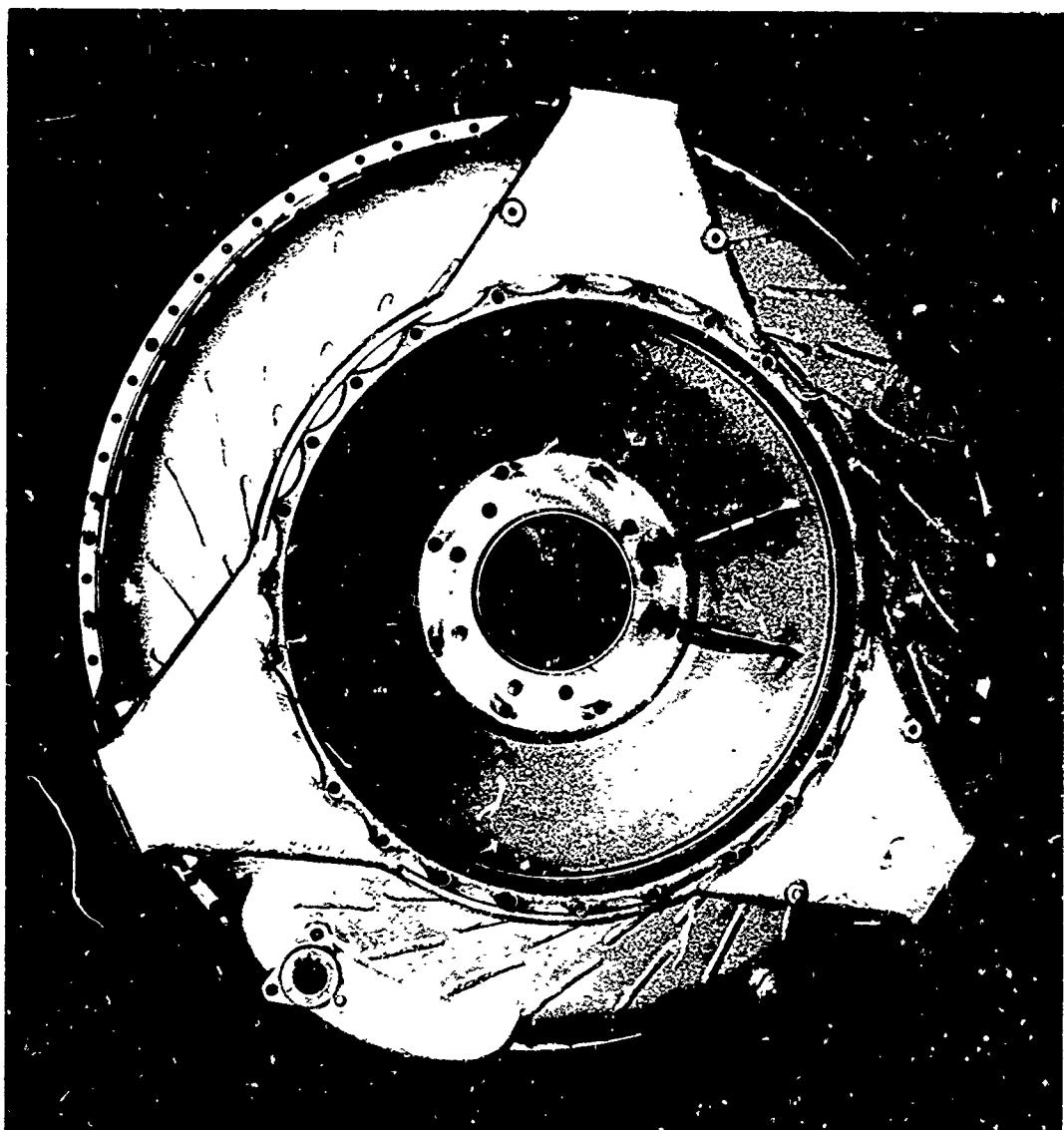


FIGURE 2  
AIR DIFFUSER FOR T-53 ENGINE  
P/N 1-110-230-01

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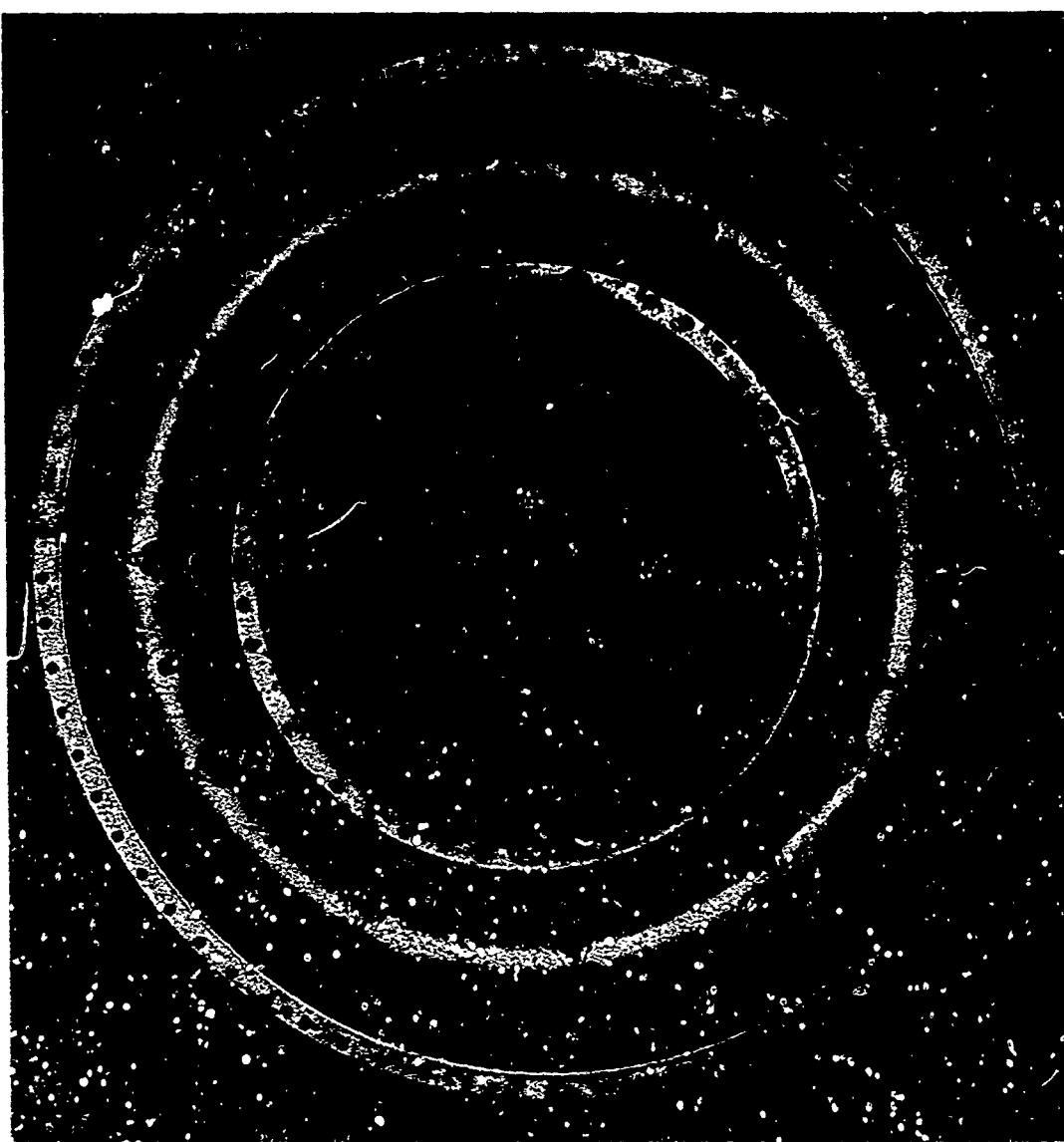


FIGURE 3

COMBUSTION CHAMBER HOUSING FOR T-53 ENGINE  
P/N 1-130-020-05

## EXPERIMENTAL PROGRESS

### Phase I

The necessary cleaning, coating, drying, humidifying and sintering equipment have been designed and/or determined. Orders for all equipment and materials have been placed with vendors, and most of the equipment has been received and is being installed. Figure 4 is a layout of the equipment to be used for this program, showing coating tanks, furnace, humidification chamber, and other support equipment.

Utilizing drawings and sectors, each four inches wide, jigs and fixtures for the three components have been prepared for use in preliminary coating trials. Photographs of these parts are shown in Figures 5, 6, and 7. The first experimental anode for each part is also shown. These anodes are constructed of stainless steel wire mesh. It is planned to begin the coating trials on these assemblies by using a 75 liter coating facility which will permit more flexibility in initial tests of electrode placement and coating deposition rates than will be possible in a large volume tank. This coating facility is shown in Figure 8.

## FUTURE WORK

1. Complete remaining work necessary to installation and construction of essential equipment required for the large coating tank to accommodate the full size components.
2. Begin coating trials on 4" wide sectors using 75 liter coating equipment to check coating coverage achieved with initially designed jigs and fixtures.
3. Investigate the effects of depletion of solids from the coating bath, dispersion stability and determine methods of reconstituting the coating bath when required for proper coatings.

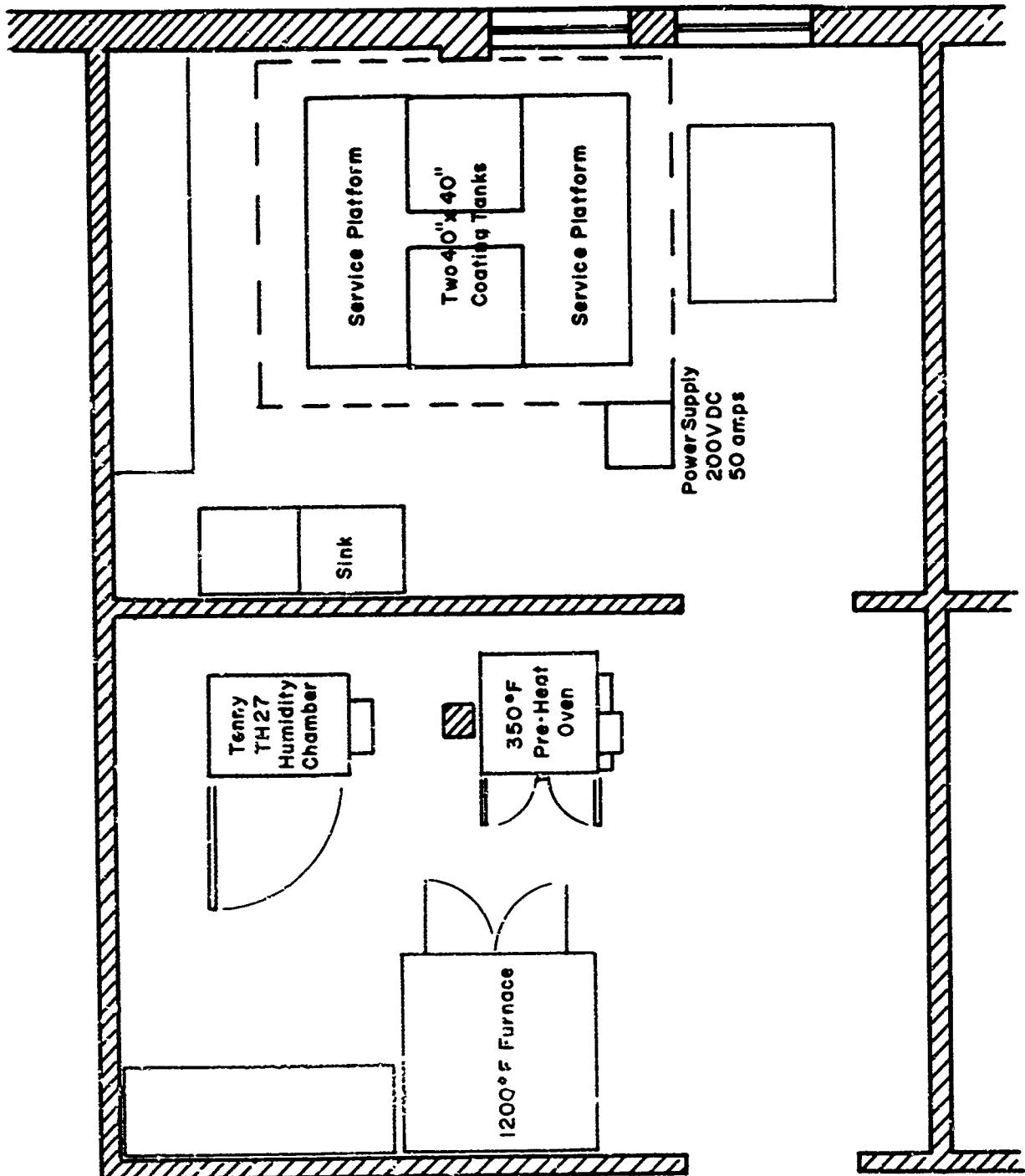


FIGURE 4  
FLOOR PLAN  
ELECTROPHORETIC COATING EQUIPMENT  
FOR COATING T-53 ENGINE COMPONENTS

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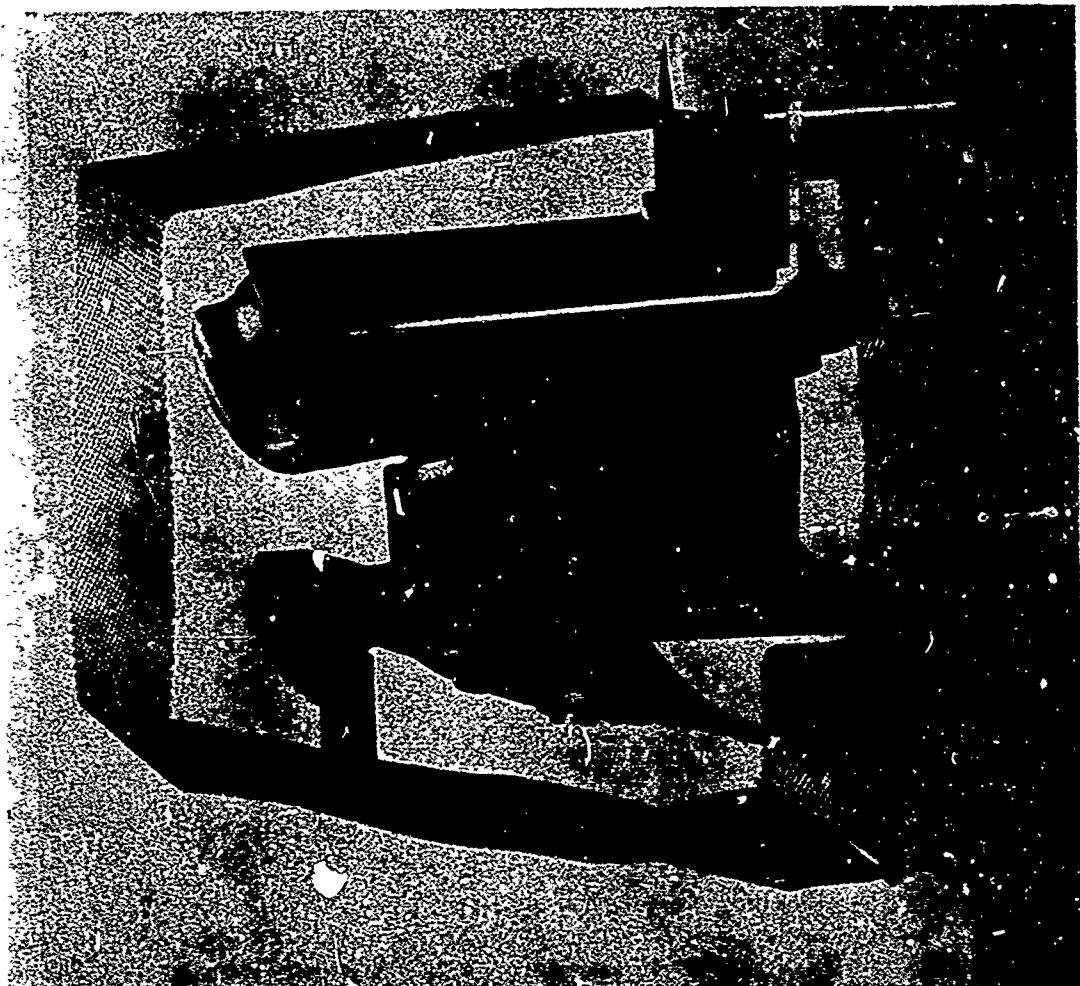


FIGURE 5  
EXHAUST DIFFUSER SECTOR WITH TRIAL ELECTRODE

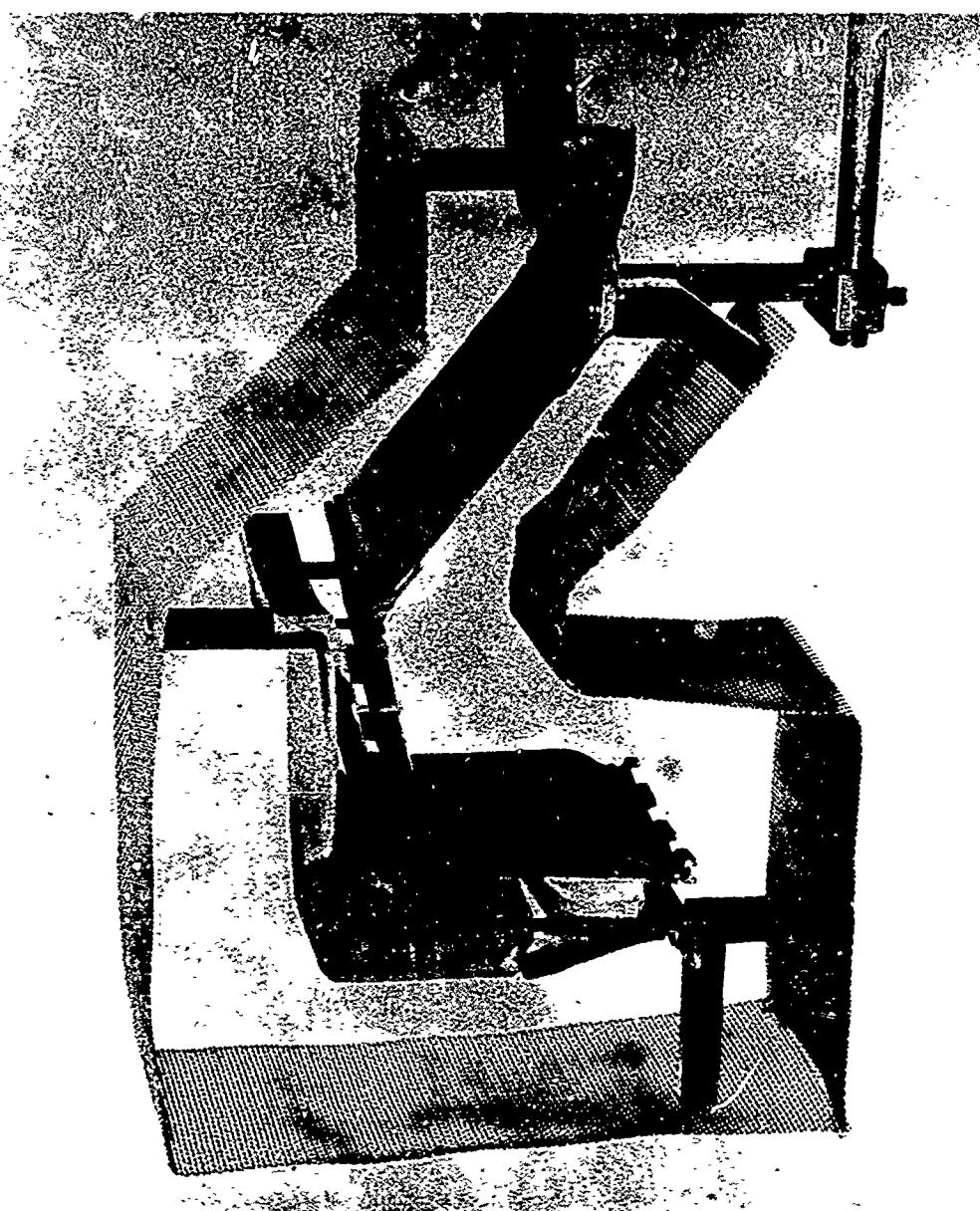


FIGURE 6  
AIR DIFFUSER SECTOR WITH TRIAL ELECTRODE

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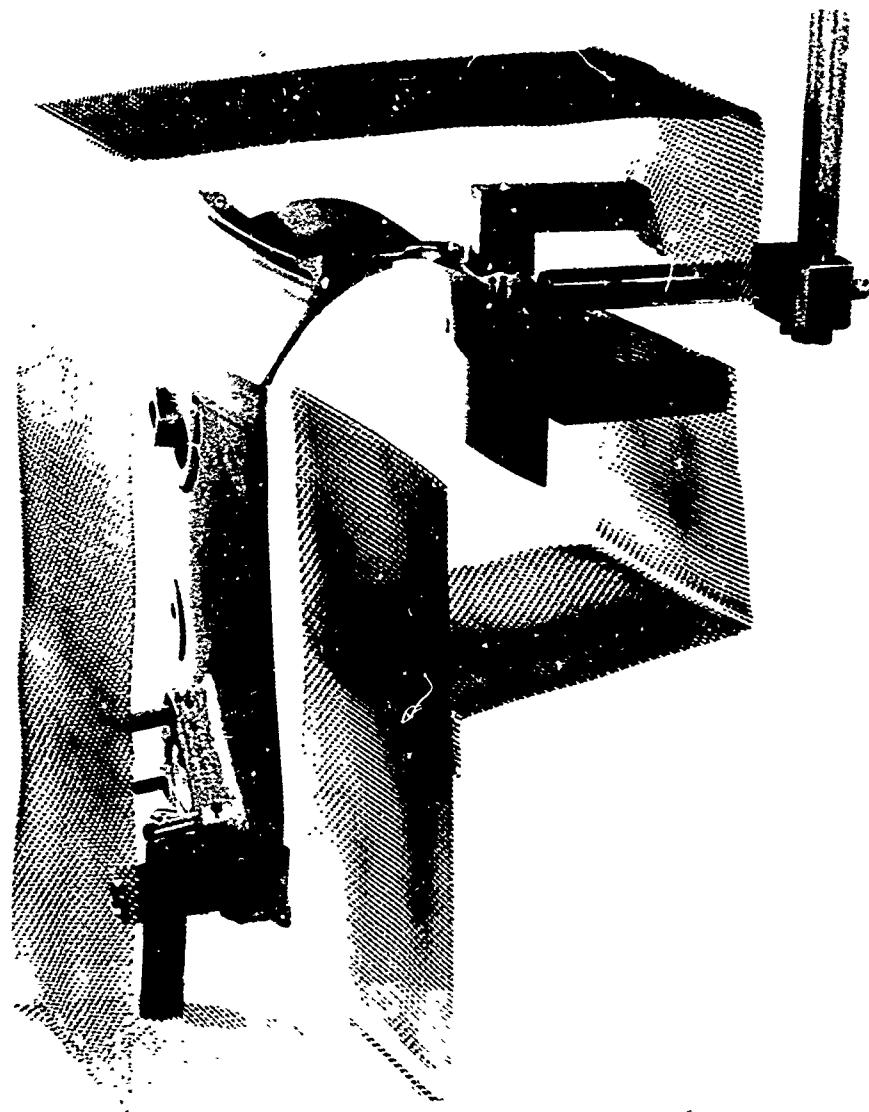


FIGURE 7  
COMBUSTION CHAMBER HOUSING SECTOR  
WITH TRIAL ELECTRODE

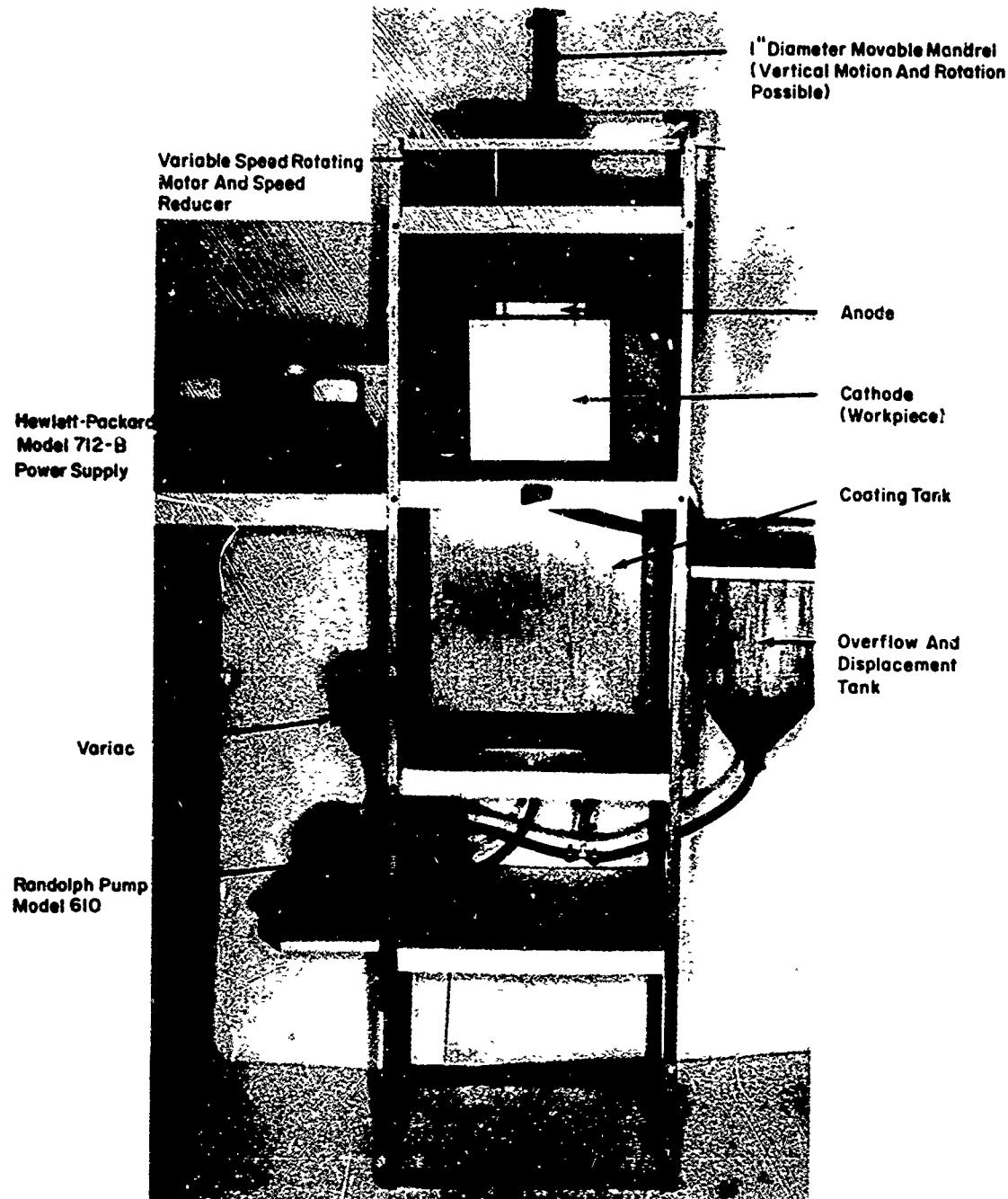


FIGURE 8  
ELECTROPHORETIC COATING TANK  
AND AUXILIARY EQUIPMENT

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